IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Yue Kuo
Serial No.:	09/736,043
Filing Date:	December 12, 2000
Group Art Unit:	2823
Examiner:	William D. Coleman
Title:	SEMICONDUCTOR CONDUCTIVE PATTERN FORMATION METHOD

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Dear Sir:

RESPONSE PURSUANT TO 37 C.F.R. § 1.116

In response to the Office Action mailed July 3, 2003, Applicant respectfully requests the Examiner to reconsider the rejection of the claims in view of the following comments as set forth below.

DAL01:735356.1

For the convenience of the Examiner, all pending claims are presented below. No amendments are made.

1. **(Previously Amended)** A method for forming a conductive pattern for a semiconductor device, comprising:

patterning a mask layer outwardly from a conductive layer of the semiconductor device, the patterning defining portions of the conductive layer where vias through the conductive layer are desired;

exposing the semiconductor device to a plasma using a plasma deposition reactor, the plasma converting the unmasked portions of the conductive layer into a compound;

exposing the semiconductor device to a treatment process, the treatment process selectively removing the compound; and

wherein exposing the semiconductor device to a treatment process comprises:

exposing the semiconductor device to a substantially inert atmosphere; and

heating the semiconductor device to between 300 and 800 degrees Celsius while the semiconductor device is exposed to the substantially inert atmosphere to remove the compound.

2. **(Original)** The method of Claim 1, wherein the conductive layer comprises a copper material.

3. **(Original)** The method of Claim 1, further comprising removing the mask layer from the semiconductor device.

4. **(Original)** The method of Claim 3, wherein removing the mask layer comprises removing the mask layer after removing the compound.

5. **(Original)** The method of Claim 3, wherein removing the mask layer comprises removing the mask layer before removing the compound.

6. **(Previously Canceled)** The method of Claim 1, wherein exposing the semiconductor device to a treatment process comprises:

exposing the semiconductor device to a substantially inert atmosphere; and

heating the semiconductor device to between 300 and 800 degrees Celsius to remove the compound.

7. **(Original)** The method of Claim 1, further comprising providing a barrier layer between the conductive material and a substrate of the semiconductor device.

8. **(Original)** The method of Claim 1, wherein the conductive material comprises a copper material, and wherein exposing the semiconductor device to a plasma comprises exposing the semiconductor device to a chlorine-containing gas.

9. **(Original)** The method of Claim 8, wherein the compound comprises a copper chloride material, and wherein exposing the semiconductor device to a treatment process comprises exposing the semiconductor device to a hydrogen chloride solution to remove the copper chloride material.

10. **(Original)** The method of Claim 1, wherein the mask layer comprises a photoresist material.

11. **(Previously Amended)** A method for forming a conductive pattern for an electronic device, comprising:

forming a conductive layer outwardly from a substrate of the electronic device;

patterning a mask layer outwardly from the conductive layer, the patterning defining portions of the conductive layer where vias through the conductive layer are desired;

exposing the electronic device to a plasma using a plasma deposition reactor and at least one other gas selected from the group of inert gases and nitrogen, the plasma converting the unmasked portions of the conductive layer into a compound and the at least one other gas enhancing the conversion into the compound;

in a separate process from forming the compound, exposing the electronic device to a treatment process to selectively remove the compound;

removing the mask layer from the masked portions of the conductive layer; and

wherein exposing the electronic device to a treatment process comprises:

exposing the electronic device to a substantially inert atmosphere; and

heating the electronic device to between 300 and 800 degrees Celsius while the electronic device is exposed to the substantially inert atmosphere to remove the compound.

12. **(Original)** The method of Claim 11, wherein removing the mask layer comprises removing the mask layer before removing the compound.

13. **(Original)** The method of Claim 11, wherein forming a conductive layer comprises forming a copper layer outwardly from the substrate.

14. **(Original)** The method of Claim 11, wherein the plasma comprises a gas having an element selected from the halogen group of elements.

15. **(Original)** The method of Claim 11, further comprising providing a barrier layer between the conductive layer and the substrate of the electronic device.

16. **(Original)** The method of Claim 11, wherein exposing the electronic device to a plasma comprises controlling the exposure of the electronic device to the plasma to form a substantially perpendicular interface between the masked conductive material and the compound.

17. **(Original)** The method of Claim 11, wherein patterning a mask layer comprises patterning a photoresist layer outwardly from the conductive layer.

18. **(Original)** A method for forming a conductive pattern for an electronic device, comprising:

masking a portion of a conductive layer of the electronic device, the masked portion of the conductive layer defining the conductive pattern;

exposing the electronic device to a plasma and at least one other gas selected from the group of inert gases and nitrogen, the plasma converting an unmasked portion of the conductive layer into a compound and the at least one other gas enhancing the conversion into the compound; and

in a separate process from forming the compound, exposing the electronic device to a treatment process, the treatment process selectively removing the compound.

19. **(Original)** The method of Claim 18, wherein masking a portion of a conductive layer comprises depositing a photoresist layer outwardly from a portion of the conductive layer.

20. **(Original)** The method of Claim 19, further comprising removing the photoresist layer after removing the compound.

21. **(Original)** The method of Claim 19, further comprising removing the photoresist layer before removing the compound.

22. **(Original)** The method of Claim 18, wherein exposing the electronic device to a plasma comprises exposing the electronic device to a plasma, the plasma comprising a gas having an element selected from the halogen group of elements.

23. **(Original)** The method of Claim 22, wherein the plasma comprises a chlorine-containing gas.

24. **(Original)** The method of Claim 22, wherein the plasma comprises a bromine-containing gas.

25. **(Original)** The method of Claim 22, wherein the plasma comprises a fluorine-containing gas.

26. **(Original)** The method of Claim 22, wherein the plasma comprises an iodine-containing gas.

27. **(Original)** The method of Claim 18, wherein exposing the electronic device to a plasma comprises controlling the exposure of the electronic device to the plasma to form a substantially perpendicular interface between the masked conductive material and the compound.

28. **(Original)** The method of Claim 18, wherein the conductive layer comprises a copper material.

29. **(Original)** The method of Claim 28, wherein exposing the electronic device comprises exposing the electronic device to a plasma, the plasma comprising a chlorine-containing gas, the plasma converting the unmasked portion of the conductive layer to copper chloride.

30. **(Original)** The method of Claim 29, wherein exposing the electronic device to a treatment process comprises exposing the electronic device to a hydrogen chloride solution to remove the copper chloride.

31. **(Original)** A method for forming a conductive pattern for a device, comprising:

patterning a mask layer outwardly from a conductive layer of the device, the patterning defining portions of the conductive layer where vias through the conductive layer are desired;

exposing, by a plasma deposition reactor, the device to a plasma, the plasma converting the unmasked portions of the conductive layer into a compound; and

exposing the device to a treatment process, the treatment process selectively removing the compound.

32. **(Previously Amended)** A method for forming a conductive pattern for a device, comprising:

patterning a mask layer outwardly from a conductive layer of the device, the patterning defining portions of the conductive layer where vias through the conductive layer are desired;

exposing the device to a plasma having an energy level of approximately 30 volts or below, the plasma converting the unmasked portions of the conductive layer into a compound; and

exposing the device to a treatment process, the treatment process selectively removing the compound.